

# PATENT ABSTRACTS OF JAPAN

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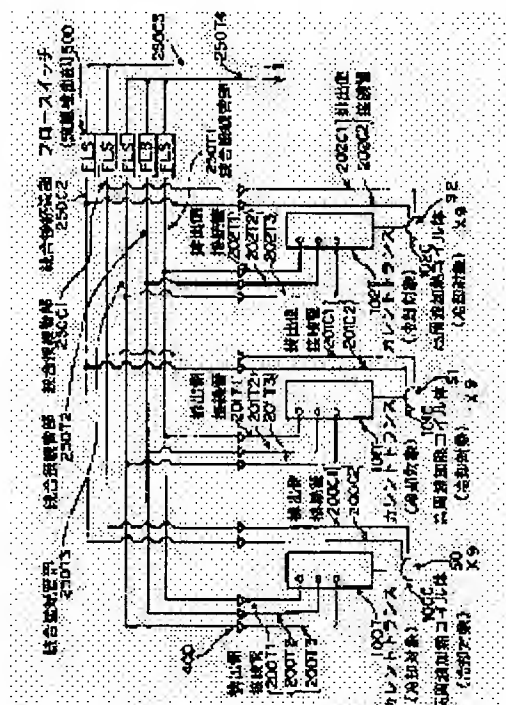
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## (54) HIGH FREQUENCY HARDENING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a high frequency hardening device at a low cost by reducing the number of installation of expensive flow rate detection parts.

SOLUTION: In a high frequency hardening device having high frequency heating coil bodies 100C, 101C, 102C, and current transformers 100T, 101T, 102T as a plurality of objects to be cooled which are not simultaneously cooled, downstream sides of refrigerant discharge side connection pipes 200C1-202C1, 200C2-202C2, 200T1-200T3, 201T1-201T3, 202T1-202T3 which are connected to each objective part to be cooled of each object to be cooled have integrated connection pipe parts 250C1, 250C2, 250T1-250T3 in which the discharge side connection pipes connected to the same objective parts to be cooled of different objects to be cooled are integrated with each other. A flow switch 500 as a flow rate detection part is disposed on the integrated connection pipe parts 250C1, 250C2, 250T1-250T3.



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CLAIMS

[Claim(s)]

[Claim 1] It is high-frequency-induction-hardening equipment which carries out [ that the downstream of each eccentric side communication trunk of the coolant connected to each section for cooling for / aforementioned / each / cooling has the integrated communication-trunk section with which the eccentric side communication trunks connected to the section for cooling of the same kind for / different / cooling are unified, and a flow rate detecting element is prepared in this integrated communication-trunk section in the high-frequency-induction-hardening equipment which has two or more candidates for cooling which are not cooled simultaneously, and ] as the feature.

[Translation done.]

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.....  
DESCRIPTION OF DRAWINGS  
.....

[Brief Description of the Drawings]

[Drawing 1] It is the rough block diagram showing the portion of the high-frequency-heating coil object of high-frequency-induction-hardening equipment and current transformer concerning the gestalt of operation of this invention, and an eccrissis side communication trunk.

[Drawing 2] It is the rough block diagram showing the portion of the high-frequency-heating coil object of conventional high-frequency-induction-hardening equipment, a current transformer, and an eccrissis side communication trunk.

[Description of Notations]

100C-102C High-frequency-heating coil object (candidate for cooling)

100T-102T Current transformer (candidate for cooling)

200C1 to 202C1, 200C2 to 202C2 Eccrissis side communication trunk

200T1-3, 201T1-3, 202T1-3 Eccrissis side communication trunk

250C1, 250C2 Integrated communication-trunk section

250T1-3 Integrated communication-trunk section

500 Flow Switch (Flow Rate Detecting Element)

.....  
[Translation done.]

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the high-frequency-induction-hardening equipment which has two or more candidates for cooling (two or more high-frequency-heating coil objects and current transformers) which are not cooled simultaneously.

[0002]

[Description of the Prior Art] As high-frequency-induction-hardening equipment which has two or more candidates for cooling (that is, two or more high-frequency-heating coil objects and current transformers which do not function simultaneously) which are not cooled simultaneously conventionally, there is high-frequency-induction-hardening equipment of a crankshaft as shown in drawing 2, for example.

[0003] However, by this drawing 2, it is high-frequency-induction-hardening equipment which has three hardening stations S0, S1, and S2 which do not function simultaneously, and only the eccrisis side-related thing is shown among the portions relevant to the aforementioned candidate for cooling. Moreover, the illustration ellipsis is carried out about the portion prepared in the cross direction on a drawing.

[0004] That is, although the high-frequency-heating coil object for tempering at the four pin sections and the five journal sections is prepared in every nine cross directions of a drawing when a crankshaft is the thing of a 4-cylinder, in drawing 2, it is illustrating about every one [100C (for the hardening stations S0), 101C (for the hardening stations S1), 102C (for the hardening stations S2)] of them. Moreover, although nine sets of portions which are connected to these high-frequency-heating coil objects 100C, 101C, and 102C and which are mentioned later are similarly prepared at a time in the cross direction of a drawing, in drawing 2, it is illustrating about one only of sets of it.

[0005] Conventional high-frequency-induction-hardening equipment Therefore, the high-frequency-heating coil objects 100C, 101C, and 102C, The current transformers 100T, 101T, and 102T which supply RF power to these high-frequency-heating coil objects 100C, 101C, and 102C, It has the supply side communication trunk (illustration ellipsis) connected so that it may mention later in current and transformer 100T grades, such as aforementioned high-frequency-heating coil object 100C, and eccrisis side communication-trunk 300C1 grade and 300T1 grade.

[0006] Moreover, conventional high-frequency-induction-hardening equipment has the solenoid valve and manual bulb which are prepared in the aforementioned supply side communication trunk, respectively, the check valve 400 prepared in the aforementioned eccrisis side communication-trunk 300C1 grade and the 300T1 grade, respectively, and the flow switch 500 as a flow rate detecting element.

[0007] Furthermore, conventional high-frequency-induction-hardening equipment has eight more sets for what makes one set such composition (what was shown in drawing 2), and the thing of the same composition (however, the high-frequency-heating coil object for the pin sections differs in a configuration from the high-frequency-heating coil object for the journal sections.) as the aforementioned one set in the cross direction on the drawing of drawing 2.

[0008] Hereafter, the aforementioned one set is represented and explained. The internal intercooling liquid path which is not illustrated, respectively is established in the aforementioned high-frequency-heating coil objects 100C-102C and the current transformers 100T-102T. However, this internal intercooling liquid path is divided into the following sections for cooling, for example. The internal intercooling liquid path of the high-frequency-heating coil objects 100C-102C is divided into two, a right half and a left half, respectively. Moreover, the current transformers 100T-102T are divided into two by the primary side coil (illustration ellipsis), and are divided into one and a total of three sections for cooling by the secondary coil (illustration ellipsis), respectively.

[0009] The supply side communication trunk which is not illustrated is connected to the end side of the internal intercooling liquid path of each section for cooling, respectively. The solenoid valve and the manual bulb are prepared in the middle of this supply side communication trunk. This solenoid valve is a portion which holds whether the coolant is incorporated to an internal intercooling liquid path side. A manual bulb is a portion which adjusts the amount of incorporation of the aforementioned coolant.

[0010] On the other hand, while communication-trunk

300C1, 300C2, 300T1, 300T2, 300T3, 301C1, 301C2, 301T1, 301T2, 301T3, 302C1, 302C2, 302T1, 302T2, 302T3 are connected to the other end side of the internal intercooling liquid path of each section for cooling the eccrisis side, the check valve 400 and the flow switch 500 are formed in the middle, respectively.

[0011] Among these, the eccentric side communication trunk 300C1, 300C2 is connected to high-frequency-heating coil object 100C. The eccentric side communication trunk 300C1 is connected to the right half side of high-frequency-heating coil object 100C, and the eccentric side communication trunk 300C2 is connected to the left half side of high-frequency-heating coil object 100C. The eccentric side communication trunk 301C1, 301C2 is connected to high-frequency-heating coil object 101C like the following. Moreover, the eccentric side communication trunk 302C1, 302C2 is connected to high-frequency-heating coil object 102C.

[0012] On the other hand, communication-trunk 300T1-300T3 are connected to current transformer 100T the discharge side. Communication-trunk 300T1, 300T2 are connected to the primary side coil (two sections for cooling) the discharge side, respectively. Communication-trunk 300T3 are connected to the secondary coil the discharge side. Communication-trunk 301T1-301T3 are connected to current transformer 101T the discharge side like the following. Moreover, communication-trunk 302T1-302T3 are connected to current transformer 102T the discharge side.

[0013] The downstream of the discharge side communication trunk 300C1, 300C2, 301C1, 301C2, 302C1, 302C2 is unified, and has become discharge side integrated communication-trunk section 350C. Moreover, the discharge side, the downstream of communication-trunk 300T1-300T3, 301T1-301T3, 302T1-302T3 is unified, and has become integrated communication-trunk section 350T the discharge side.

[0014] In addition, the aforementioned check valve 400 is a valve for preventing an adverse current. For example, when exchanging high-frequency-heating coil object 101C of the hardening station S1, performing hardening at the hardening station S0, a check valve 400 works so that the coolant currently sent to high-frequency-heating coil object 100C may not spout very much via eccentric side integrated communication-trunk section 350C into the portion which removed high-frequency-heating coil object 101C. Moreover, this check valve 400 is formed in order not to carry out adverse current close [ of the heated coolant which is discharged from the high-frequency-heating coil object and current transformer of the hardening station which is performing hardening ] to the high-frequency-heating coil object or current transformer of a hardening station which omit hardening.

[0015] moreover, the function to send an alarm signal to the control section in equipment (illustration ellipsis) if a flow switch 500 detects and displays the flow rate of the coolant which flows the inside of the pipe of the portion prepared and it is less than the set point (the amount of minimums is usually set up.) -- an owner -- it is a thing the bottom The aforementioned control section makes an alarm lamp turn on, and can sound an alarm buzzer depending on the case while it will stop the whole equipment, if an alarm signal is received.

[0016] Thus, it is because it usually means that are an upstream and the following states have occurred rather than the portion in which the flow switch 500 is formed for the situation that the flow rate of the coolant is less than the set point that it will stop the whole equipment if the aforementioned control section receives the alarm signal from the aforementioned flow switch 500. For example, it is in the state where the coolant is beginning to leak and the flow rate is falling by the crack of a pipe etc., the state where get a pipe blocked and the flow rate is falling, and the state where abnormalities arise in a coolant feed pump and the flow rate is falling.

[0017] It is because current or transformer 100T grades, such as high-frequency-heating coil object 100C concerning an applicable part, overheat, and it will be damaged, or the amount of current will change, and the amount of heating to a work will change, as a result the hardening depth will become unsuitable and many defectives will be made, if such a state is left.

[0018]

[Problem(s) to be Solved by the Invention] In order to prevent it, as mentioned above, the aforementioned flow switch 500 is formed in the downstream for every section for cooling 1 to 1. However, this flow switch 500 is expensive. Therefore, a large number had become [ whose a work is ] like a crankshaft with the obstacle of eye a required hatchet and low-cost-izing of equipment as mentioned above. In the above-mentioned case, the 5x3(place) x9(number formed in cross direction of drawing) = 135 piece was also required for the flow switch 500 [a flow rate detecting element].

[0019] The main purpose of this invention is to cut down the number of installation of an expensive flow rate detecting element, and offer low cost high-frequency-induction-hardening equipment.

[0020]

[Means for Solving the Problem] In order to solve the above-mentioned problem, the high-frequency-induction-hardening equipment concerning this invention The downstream of each discharge side communication trunk of the coolant which is high-frequency-induction-hardening equipment which has two or more candidates for cooling which are not cooled simultaneously, and is connected to each section for cooling for [ aforementioned / each ] cooling It is good to have the integrated communication-trunk section with which the discharge side communication trunks connected to the section for cooling of the same kind for [ different ] cooling are unified, and to prepare a flow rate detecting element in this integrated communication-trunk section.

[0021]

[Embodiments of the Invention] Hereafter, the high-frequency-induction-hardening equipment concerning the form of operation of this invention is explained, referring to drawing 1. Drawing 1 is the rough block diagram showing the portion of the high-frequency-heating coil object of high-frequency-induction-hardening equipment and current transformer concerning the form of operation of this invention, and a discharge side communication trunk. In addition, the same number is given to the same thing as the portion in conventional high-frequency-induction-hardening equipment.

[0022] The high-frequency-induction-hardening equipment concerning the form of operation of this invention has three hardening stations S0, S1, and S2 not functioning, and has come to be able to carry out high-frequency induction hardening of the crankshaft

of the 4-cylinder which is a work simultaneously, respectively. Therefore, like drawing 2, although drawing 1 is also carrying out the illustration abbreviation, eight more sets of things of the same composition as drawing 1 are prepared in the cross direction on a drawing.

[0023] Therefore, the high-frequency-induction-hardening equipment concerning the form of operation of this invention has the high-frequency-heating coil objects 100C, 101C, and 102C and the current transformers 100T, 101T, and 102T which supply RF power to these high-frequency-heating coil objects 100C, 101C, and 102C.

[0024] Moreover, the high-frequency-induction-hardening equipment concerning the form of operation of this invention The supply side communication trunk (illustration abbreviation) connected so that it may mention later in current and transformer 100T grades, such as aforementioned high-frequency-heating coil object 100C, and discharge side communication-trunk 200C1 grade and 200T1 grade, The solenoid valve and manual bulb which are prepared in the aforementioned supply side communication trunk, respectively, It has the check valve 400 prepared in the aforementioned discharge side communication-trunk 200C1 grade and the 200T1 grade, respectively, and the flow switch 500 as a flow rate detecting element prepared in the integrated communication-trunk section 250C1 grade of discharge side communication-trunk 200C1 grade and 200T1 grade mentioned later, respectively.

[0025] Furthermore, the high-frequency-induction-hardening equipment concerning the form of operation of this invention has eight more sets for what makes one set such composition (what was shown in drawing 1), and the thing of the same composition (however, the high-frequency-heating coil object for the pin sections differs in a configuration from the high-frequency-heating coil object for the journal sections.) as the aforementioned one set in the cross direction on the drawing of drawing 1.

[0026] Hereafter, the aforementioned one set is represented and explained. The aforementioned high-frequency-heating coil objects 100C, 101C, and 102C are set as two or more cooling objects which are not cooled simultaneously. Moreover, the current transformers 100T, 101T, and 102T are also set as two or more cooling objects which are not cooled simultaneously. Of course, the internal intercooling liquid path is established in the high-frequency-heating coil objects 100C-102C and the current transformers 100T-102T.

[0027] Moreover, the composition of the section for cooling which is not illustrated is the same as the case of conventional high-frequency-induction-hardening equipment. That is, the high-frequency-heating coil objects 100C-102C are divided into the two sections for cooling, a right half and a left half. The current transformers 100T-102T are divided into two by the primary side coil (illustration abbreviation), and are divided into one and a total of three sections for cooling by the secondary coil (illustration abbreviation), respectively.

[0028] The supply side communication trunk which is not illustrated, respectively is connected to the end side of the internal intercooling liquid path of each section for cooling. The aforementioned solenoid valve and the manual bulb are prepared in the middle of this supply side communication trunk.

[0029] While communication-trunk

200C1,200C2,200T1,200T2,200T3,201C1,201C2,201T1,201T2,201T3,202C1,202C2,202T1,202T2,202T3 are connected to the other end side of the internal intercooling liquid path of each section for cooling the discharge side for every section for cooling, the check valve 400 is formed in the middle, respectively.

[0030] Among these, the discharge side communication trunk 200C1,200C2 is connected to high-frequency-heating coil object 100C. The discharge side communication trunk 200C1 is connected to the right half side of high-frequency-heating coil object 100C, and the discharge side communication trunk 200C2 is connected to the left half side of high-frequency-heating coil object 100C. The discharge side communication trunk 201C1,201C2 is connected to high-frequency-heating coil object 101C like the following. Moreover, the discharge side communication trunk 202C1,202C2 is connected to high-frequency-heating coil object 102C.

[0031] On the other hand, communication-trunk 200T1-200T3 are connected to current transformer 100T the discharge side. Communication-trunk 200T1,200T2 are connected to the primary side coil (two sections for cooling) the discharge side, respectively. Communication-trunk 200T3 are connected to the secondary coil the discharge side. Communication-trunk 201T1-201T3 are connected to current transformer 101T the discharge side like the following. Moreover, communication-trunk 202T1-202T3 are connected to current transformer 102T the discharge side.

[0032] The downstream of each [ these ] discharge side communication-trunk 200C1 grade and 200T1 grade forms integrated communication-trunk section 250C1,250C2,250T1,250T2,250T3.

[0033] That is, the integrated communication-trunk section 250C1 is the portion which unified the downstream of the discharge side communication trunk 200C1,201C1,202C1 connected to the section for cooling of the same kind for [ different ] cooling. The integrated communication-trunk section 250C2 is the portion which unified the downstream of the discharge side communication trunk 200C2,201C2,202C2 like the following. Integrated communication-trunk section 250T1 is the portion which unified the downstream of communication-trunk 200T1,201T1,202T1 the discharge side. Integrated communication-trunk section 250T2 are the portion which unified the downstream of communication-trunk 200T2,201T2,202T2 the discharge side. Integrated communication-trunk section 250T3 are the portion which unified the downstream of communication-trunk 200T3,201T3,202T3 the discharge side.

[0034] In the middle of these integrated communication-trunk section 250C1,250C2,250T1-250T3, the aforementioned flow switch 500 is formed, respectively.

[0035] the portion in which this flow switch 500 was formed -- the portion of a downstream -- further -- unifying -- the coolant piping section 250C3 for coils, and the object for current transformers -- it is made coolant piping section 250T4

[0036] With the high-frequency-induction-hardening equipment concerning the form of operation of this invention constituted as

mentioned above A flow switch 500 is formed in integrated communication-trunk section 250C1,250C2,250T1-250T3, respectively. And since the coolant (coolant after using it for cooling) flowed at one time only from any one of the discharge side three ] communication trunks of a unifying agency, respectively but the check valve 400 has moreover prevented the adverse current as usual The flow rate change by the crack of each section for cooling in the upstream of each discharge side communication trunk, the pipe in a supply side communication trunk, etc. is exactly measurable as usual.

[0037] Therefore, with the high-frequency-induction-hardening equipment concerning the form of operation of this invention constituted as mentioned above, only the 5x9(number formed in cross direction on drawing of drawing 1) =45 piece of the number of flow switches 500 is good. Therefore, the number of flow switches 500 will be good at 1/3 over the past.

[0038] In addition, in the high-frequency-induction-hardening equipment concerning the form of operation of this invention, even if it is the coil object of a configuration which is mutually different and the aforementioned high-frequency-heating coil objects 100C, 101C, and 102C are coil objects of the same configuration, influence does not have them in measurement of a flow switch 500. Moreover, even if it also arranges especially neither the tube diameter of each discharge side communication trunk, nor the tube diameter of the integrated communication-trunk section, it is uninfluent to measurement of a flow switch 500.

[0039] In the high-frequency-induction-hardening equipment concerning the form of operation of this invention, although the number of hardening stations was set to three, it is good also as two or four or more. For example, if the same composition is applied when the number of hardening stations is four, the number of flow switches 500 becomes good by the number of the conventional quadrants.

[0040] The two remaining are good, though the number of hardening stations is one, for example, the thing of the composition of the high-frequency-induction-hardening equipment concerning the form of operation of this invention is exchanged as an exchange unit if needed. As an exchange unit, in this case, to separate the portion immediately under the check valve 400 in drawing 1, and what is necessary is [ are moved and ] just made to be exchanged.

[0041] Though the portion (it is got blocked and the portion prepared before and behind on the drawing of drawing 1 is not included.) shown only by drawing 1 of the high-frequency-induction-hardening equipment concerning the form of operation of this invention constitutes one hardening station, it is good. That is, even if it is the composition that the high-frequency-heating coil objects 100C, 101C, and 102C are heating by time sharing to one work, the number of flow switches 500 can be done in 1/3 over the past.

[0042] Although the number of partitions of the section for cooling in the high-frequency-induction-hardening equipment concerning the form of operation of this invention set to two about the high-frequency-heating coil object, it is good also as 1 or three or more. Moreover, although the number of partitions of the section for cooling of a current transformer set to three, it is good also as 1, 2, or four or more.

[0043] It seems that a flow rate is detected and the data of the flow rate may be sent to the aforementioned control section in the high-frequency-induction-hardening equipment concerning the form of operation of this invention although a flow rate detecting element is a flow switch instead.

[0044]

[Effect of the Invention] The high-frequency-induction-hardening equipment which applies to this invention as explained above was high-frequency-induction-hardening equipment which has two or more candidates for cooling which are not cooled simultaneously, it has the integrated communication-trunk section with which the discharge side communication trunks connected to the section for cooling of the same kind for [ different ] cooling are unified, and the downstream of each discharge side communication trunk of the coolant connected to each section for cooling for [ aforementioned / each ] cooling prepared a flow rate detecting element to this integrated communication-trunk section.

[0045] Therefore, in the case of the high-frequency-induction-hardening equipment concerning this invention, since the flow rate detecting element was prepared in the integrated communication-trunk section, the number of installation of a flow rate detecting element is sharply reducible. Therefore, low-cost-ization of the high-frequency-induction-hardening equipment concerning this invention is attained.

[Translation done.]

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TITLE: Induction hardening  
apparatus has high frequency heating  
coils and transformers with  
their outlet coolant and  
emission pipes integrated at  
downstream side and provided  
with flow detecting switch at  
integrated end

PATENT-ASSIGNEE: FUJI ELECTRONICS IND CO LTD[FJID]

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ABSTRACTED-PUB-NO: JP2000192135A

BASIC-ABSTRACT:

NOVELTY - The downstream side of each outlet side coolant connecting pipe (200C1-202C1) connected to each high frequency heating coils (100C-102C), are unified. Similarly the emission side pipes (250T1-250T3) of each transformers (100T-102T) are unified. Integrated connecting pipes (250C1-250C2) and emission pipes (250T1-250T3) are provided with flow detecting switch (500) at outlet side.

USE - Induction hardening apparatus.

ADVANTAGE - Due to provision of flow switch at the integrated connecting pipe end, number of installation components and hence cost of induction hardening apparatus are reduced.

DESCRIPTION OF DRAWING(S) - The figure shows circuit diagram of induction hardening apparatus.

High frequency heating coils 100C-102C

Transformers 100T-102T

Outlet side coolant connecting pipe 200C1-202C1

Integrated connecting pipes 250C1-250C2

Emission pipes 250T1-250T3

Detecting switch 500

CHOSEN-DRAWING: Dwg.1/2

TITLE-TERMS: INDUCTION HARDEN APPARATUS HIGH  
FREQUENCY HEAT COIL TRANSFORMER  
OUTLET COOLANT EMIT PIPE INTEGRATE  
DOWNSTREAM SIDE FLOW DETECT  
SWITCH INTEGRATE END

DERWENT-CLASS: M24 X25

CPI-CODES: M24-D02A; M24-D04;

EPI-CODES: X25-B02A; X25-Q02;

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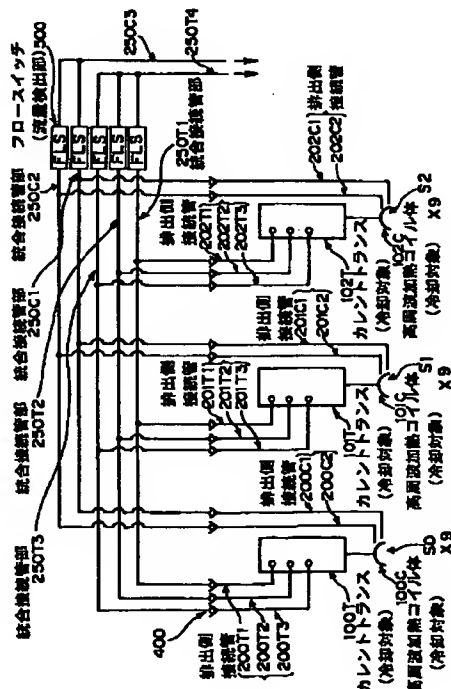
CD52 CD54 CD72 CD74

(54) 【発明の名称】 高周波焼入装置

(57) 【要約】

【目的】 高価な流量検出部の設置数を削減して低コストな高周波焼入装置を提供する。

【構成】 同時に冷却されることのない複数の冷却対象としての高周波加熱コイル体 100C、101C、102C およびカレントトランス 100T、101T、102T を有する高周波焼入装置であって、前記各冷却対象の各冷却対象部に接続されている冷却液の各排出側接続管 200C1~202C1、200C2~202C2、200T1~3、201T1~3、202T1~3 の下流側は、異なる冷却対象の同種の冷却対象部に接続されている排出側接続管同士が統合されている統合接続管部 250C1、250C2、250T1~3 を有し、この統合接続管部 250C1、250C2、250T1~3 に流量検出部としてのフロースイッチ 500 を設ける。



## 【特許請求の範囲】

【請求項1】 同時に冷却されることのない複数の冷却対象を有する高周波焼入装置において、前記各冷却対象の各冷却対象部に接続されている冷却液の各排出側接続管の下流側は、異なる冷却対象の同種の冷却対象部に接続されている排出側接続管同士が統合されている統合接続管部を有し、この統合接続管部に流量検出部が設けられていることを特徴とする高周波焼入装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、同時に冷却されることのない複数の冷却対象（複数の高周波加熱コイル体やカレントトランス）を有する高周波焼入装置に関する。

## 【0002】

【従来の技術】従来、同時に冷却されることのない複数の冷却対象（つまり同時に機能することのない複数の高周波加熱コイル体やカレントトランス）を有する高周波焼入装置としては、例えば、図2に示されるようなクランクシャフトの高周波焼入装置がある。

【0003】ただし、この図2では、同時に機能することのない3つの焼入ステーションS0、S1、S2を有する高周波焼入装置であって、前記冷却対象に関連する部分のうち排出側関係のもののみを示している。また、図面上の前後方向に設けられている部分については図示省略している。

【0004】つまり、クランクシャフトが例えば、4気筒のものであった場合には、4つのピン部と5つのジャーナル部とに焼入を施すための高周波加熱コイル体が図面の前後方向に9つずつ設けられているが、図2ではそのうちの1つずつ〔100C（焼入ステーションS0用）、101C（焼入ステーションS1用）、102C（焼入ステーションS2用）〕についてのみ図示している。また、この高周波加熱コイル体100C、101C、102Cに接続されている後述する部分も同様に図面の前後方向に9セットずつ設けられているが、図2ではそのうちの1セットについてのみ図示している。

【0005】したがって、従来の高周波焼入装置は、高周波加熱コイル体100C、101C、102Cと、この高周波加熱コイル体100C、101C、102Cに高周波電力を供給するカレントトランス100T、101T、102Tと、前記高周波加熱コイル体100C等およびカレントトランス100T等に後述するように接続されている供給側接続管（図示省略）と排出側接続管300C1等、300T1等とを有している。

【0006】また、従来の高周波焼入装置は、前記供給側接続管にそれぞれ設けられているソレノイドバルブと手動バルブと、前記排出側接続管300C1等、300T1等にそれぞれ設けられているチェック弁400と流量検出部としてのフロースイッチ500とを有してい

る。

【0007】更に、従来の高周波焼入装置は、このような構成（図2に示されたもの）を1セットとするものと、前記1セットと同様の構成（ただし、ピン部用の高周波加熱コイル体とジャーナル部用の高周波加熱コイル体とは形状が異なる。）のものをあと8セットとを、図2の図面上の前後方向に有している。

【0008】以下、前記1セットについて、代表して説明する。前記高周波加熱コイル体100C～102C

と、カレントトランス100T～102Tとには、それぞれ図示しない内部冷却液通路が設けられている。ただし、この内部冷却液通路は、例えば次のような冷却対象部に分割されている。高周波加熱コイル体100C～102Cの内部冷却液通路は、それぞれ右半分と左半分の2つに分割されている。また、カレントトランス100T～102Tは、それぞれ、1次側コイル（図示省略）で2つ、2次側コイル（図示省略）で1つ、合計3つの冷却対象部に分割されている。

【0009】各冷却対象部の内部冷却液通路の一端側には、図示しない供給側接続管がそれぞれ接続されている。この供給側接続管の途中には、ソレノイドバルブと、手動バルブとが設けられている。このソレノイドバルブは、内部冷却液通路側に冷却液を取り込むか否かをとり行う部分である。手動バルブは、前記冷却液の取り込み量を調節する部分である。

【0010】一方、各冷却対象部の内部冷却液通路の他端側には、排出側接続管300C1、300C2、300T1、300T2、300T3、301C1、301C2、301T1、301T2、301T3、302C1、302C2、302T1、302T2、302T3が接続されているとともに、その途中にそれぞれチェック弁400と、フロースイッチ500とが設けられている。

【0011】このうち、排出側接続管300C1、300C2は、高周波加熱コイル体100Cに接続されているものである。排出側接続管300C1は高周波加熱コイル体100Cの右半分側に、排出側接続管300C2は高周波加熱コイル体100Cの左半分側に接続されている。以下同様に、排出側接続管301C1、301C2は、高周波加熱コイル体101Cに接続されているものである。また、排出側接続管302C1、302C2は、高周波加熱コイル体102Cに接続されているものである。

【0012】一方、排出側接続管300T1～300T3は、カレントトランス100Tに接続されているものである。排出側接続管300T1、300T2は1次側コイル（の2つの冷却対象部）にそれぞれ接続されているものである。排出側接続管300T3は、2次側コイルに接続されているものである。以下同様に、排出側接続管301T1～301T3は、カレントトランス10

1 Tに接続されているものである。また、排出側接続管302 T1~302 T3は、カレントトランス102 Tに接続されているものである。

【0013】排出側接続管300 C1、300 C2、301 C1、301 C2、302 C1、302 C2の下流側は、統合されて排出側統合接続管部350 Cになっている。また、排出側接続管300 T1~300 T3、301 T1~301 T3、302 T1~302 T3の下流側は、統合されて排出側統合接続管部350 Tになっている。

【0014】なお、前記チェック弁400は、逆流を防止するための弁である。たとえば、焼入ステーションS0で焼入作業を行いつつ、焼入ステーションS1の高周波加熱コイル体101 Cを交換するときに、高周波加熱コイル体100 Cに送られている冷却液が、排出側統合接続管部350 Cを経由して、高周波加熱コイル体101 Cを取り外した部分に至って噴出することのないように、チェック弁400が働く。また、このチェック弁400は、焼入作業を行っている焼入ステーションの高周波加熱コイル体やカレントトランスから排出される加熱された冷却液を、焼入作業を行っていない焼入ステーションの高周波加熱コイル体やカレントトランスに逆流させないためにも設けられているものである。

【0015】また、フローズスイッチ500は、設けられている部分の管内を流れる冷却液の流量を検出し表示し、設定値（通常、下限量が設定されている。）を下回ると警報信号を装置内の制御部（図示省略）に送る機能を有したものである。前記制御部は、警報信号を受けると装置全体を停止させるとともに、警報ランプの点灯をさせ、場合によっては警報ブザーを鳴らせる。

【0016】このように、前記制御部が、前記フローズスイッチ500からの警報信号を受けると装置全体を停止させるのは、冷却液の流量が設定値を下回るという状況が、フローズスイッチ500が設けられている部分よりも上流側で、次のような状態が発生していることを通常、意味しているからである。例えば、管等の亀裂等によって冷却液が漏れ出して流量が低下している状態や、管がつまって流量が低下している状態や、冷却液供給ポンプに異常が起り流量が低下している状態である。

【0017】このような状態を放置すると、該当箇所にかかる高周波加熱コイル体100 C等またはカレントトランス100 T等がオーバーヒートして損傷したり、電流量が変化して、ワークに対する加熱量が変化し、ひいては焼入深さが不適当となり、不良品が多数できてしまうからである。

【0018】

【発明が解決しようとする課題】それを防止するために、上述したように、冷却対象部ごとに、その下流側に1対1に前記フローズスイッチ500が設けられているのである。しかしながら、このフローズスイッチ500は、

高価なものである。したがって、上述のように、ワークがクランクシャフトのようなものであると、多数必要なため、装置の低コスト化の障害となっていた。上述の場合、フローズスイッチ500〔流量検出部〕は、 $5 \times 3$ （カ所） $\times 9$ （図1の前後方向に設けられている数） $= 135$ 個も必要であった。

【0019】本発明の主たる目的は、高価な流量検出部の設置数を削減して低コストな高周波焼入装置を提供することにある。

10 【0020】

【課題を解決するための手段】上記問題を解決するために、本発明に係る高周波焼入装置は、同時に冷却されることのない複数の冷却対象を有する高周波焼入装置であって、前記各冷却対象の各冷却対象部に接続されている冷却液の各排出側接続管の下流側は、異なる冷却対象の同種の冷却対象部に接続されている排出側接続管同士が統合されている統合接続管部を有し、この統合接続管部に流量検出部を設けるとよい。

【0021】

20 【発明の実施の形態】以下、本発明の実施の形態に係る高周波焼入装置を図1を参照しつつ説明する。図1は本発明の実施の形態に係る高周波焼入装置の高周波加熱コイル体とカレントトランスと排出側接続管との部分を示す概略的構成図である。なお、従来の高周波焼入装置における部分と同一のものには同一の番号を付している。

【0022】本発明の実施の形態に係る高周波焼入装置は、同時には機能しない3つの焼入ステーションS0、S1、S2を有し、それぞれが、ワークである4気筒のクランクシャフトを高周波焼入できるようになっている。そのため、図2同様、図1でも図示省略しているが、図1と同様の構成のものが図面上の前後方向にあと8セット設けられている。

【0023】したがって、本発明の実施の形態に係る高周波焼入装置は、高周波加熱コイル体100 C、101 C、102 Cと、この高周波加熱コイル体100 C、101 C、102 Cに高周波電力を供給するカレントトランス100 T、101 T、102 Tとを有している。

【0024】また、本発明の実施の形態に係る高周波焼入装置は、前記高周波加熱コイル体100 C等およびカレントトランス100 T等に後述するように接続されている供給側接続管（図示省略）と排出側接続管200 C1等、200 T1等と、前記供給側接続管にそれぞれ設けられているソレノイドバルブと手動バルブと、前記排出側接続管200 C1等、200 T1等にそれぞれ設けられているチェック弁400と、後述する排出側接続管200 C1等、200 T1等の統合接続管部250 C1等にそれぞれ設けられている流量検出部としてのフローズスイッチ500とを有している。

【0025】更に、本発明の実施の形態に係る高周波焼入装置は、このような構成（図1に示されたもの）を1

セットとするものと、前記1セットと同様の構成(ただし、ピン部用の高周波加熱コイル体とジャーナル部用の高周波加熱コイル体とは形状が異なる。)のものをあと8セットとを、図1の図面上の前後方向に有している。

【0026】以下、前記1セットについて、代表して説明する。前記高周波加熱コイル体100C、101C、102Cは、同時に冷却されることのない複数の冷却対象となっている。また、カレントトランス100T、101T、102Tも、同時に冷却されることのない複数の冷却対象となっている。もちろん、高周波加熱コイル体100C~102Cと、カレントトランス100T~102Tとは、内部冷却液通路が設けられている。

【0027】また、図示しない冷却対象部の構成も従来の高周波焼入装置の場合と同じである。即ち、高周波加熱コイル体100C~102Cは、右半分と左半分の2つの冷却対象部に分割されている。カレントトランス100T~102Tは、それぞれ、1次側コイル(図示省略)で2つ、2次側コイル(図示省略)で1つ、合計3つの冷却対象部に分割されている。

【0028】各冷却対象部の内部冷却液通路の一端側には、それぞれ図示しない供給側接続管が接続されている。この供給側接続管の途中に、前記ソレノイドバルブと、手動バルブとが設けられている。

【0029】各冷却対象部の内部冷却液通路の他端側には、各冷却対象部ごとに排出側接続管200C1、200C2、200T1、200T2、200T3、201C1、201C2、201T1、201T2、201T3、202C1、202C2、202T1、202T2、202T3が接続されているとともに、その途中にそれぞれチェック弁400が設けられている。

【0030】このうち、排出側接続管200C1、200C2は、高周波加熱コイル体100Cに接続されているものである。排出側接続管200C1は高周波加熱コイル体100Cの右半分側に、排出側接続管200C2は高周波加熱コイル体100Cの左半分側に接続されている。以下同様に、排出側接続管201C1、201C2は、高周波加熱コイル体101Cに接続されているものである。また、排出側接続管202C1、202C2は、高周波加熱コイル体102Cに接続されているものである。

【0031】一方、排出側接続管200T1~200T3は、カレントトランス100Tに接続されているものである。排出側接続管200T1、200T2は1次側コイル(の2つの冷却対象部)にそれぞれ接続されているものである。排出側接続管200T3は、2次側コイルに接続されているものである。以下同様に、排出側接続管201T1~201T3は、カレントトランス101Tに接続されているものである。また、排出側接続管202T1~202T3は、カレントトランス102Tに接続されているものである。

【0032】これら各排出側接続管200C1等、200T1等の下流側は、統合接続管部250C1、250C2、250T1、250T2、250T3を形成している。

【0033】即ち、統合接続管部250C1は、異なる冷却対象の同種の冷却対象部に接続された排出側接続管200C1、201C1、202C1の下流側を統合した部分である。以下同様に、統合接続管部250C2は、排出側接続管200C2、201C2、202C2の下流側を統合した部分である。統合接続管部250T1は、排出側接続管200T1、201T1、202T1の下流側を統合した部分である。統合接続管部250T2は、排出側接続管200T2、201T2、202T2の下流側を統合した部分である。統合接続管部250T3は、排出側接続管200T3、201T3、202T3の下流側を統合した部分である。

【0034】この統合接続管部250C1、250C2、250T1~250T3の途中には、それぞれ前記フロースイッチ500が設けられている。

【0035】このフロースイッチ500が設けられた部分よりも下流側の部分は、更に統合してコイル用冷却液配管部250C3と、カレントトランス用冷却液配管部250T4とにしている。

【0036】以上のように構成された本発明の実施の形態に係る高周波焼入装置では、フロースイッチ500は、統合接続管部250C1、250C2、250T1~250T3にそれぞれ設けられ、且つ、それぞれ統合元の3つの排出側接続管のいずれか1つからしか、一時には冷却液(冷却に使用後の冷却液)が流れて来ず、しかも、チェック弁400が従来通り逆流を防いでいるので、各排出側接続管の上流側での各冷却対象部や供給側接続管での管等の亀裂等による流量変化は従来同様に的確に計測できる。

【0037】よって、以上のように構成された本発明の実施の形態に係る高周波焼入装置では、フロースイッチ500の数は、5×9(図1の図面上の前後方向に設けられている数)=45個だけよい。したがって、フロースイッチ500の数は、従来の3分の1でよいことになる。

【0038】なお、本発明の実施の形態に係る高周波焼入装置において、前記高周波加熱コイル体100C、101C、102Cは、相互に異なる形状のコイル体であっても、同一形状のコイル体であってもフロースイッチ500の計測に影響はない。また、各排出側接続管の管径や統合接続管部の管径も、特に揃えなくてもフロースイッチ500の計測に影響はない。

【0039】本発明の実施の形態に係る高周波焼入装置において、焼入ステーションの数は3つとしたが、2つまたは4つ以上としてもよい。例えば、同様の構成を、もし、焼入ステーションの数が4つの場合に適用する



【図2】

